

miles per hour from the northwest, at noon. During the prevalence of the gale the air was filled with heavy clouds of dust and sand.

Keeler, California: on the 14th high wind set in shortly after 11 p. m. and reached before midnight a velocity of thirty miles per hour; the storm continued throughout the night and until sunset of the 15th; maximum velocity, thirty-nine miles per hour from the northwest, at 4.20 a. m. The storm raised great clouds of sand which nearly obscured the sky and rendered objects one-half a mile distant indistinguishable.

Sand storms also occurred at the following stations:

Yuma, Arizona, 10th, 15th, 16th.

Fort McDowell, Arizona, 15th, 21st.

Fort Yates, Dakota, 4th.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and fifty-eight stations show 4,730 observations to have been made, of which one was reported doubtful; of the remainder, 4,729, there were 4,222, or 89.3 per cent., followed by the expected weather.

SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for November, 1886:

Date— November, 1886. Standard time.	No. of new.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
2, 11 a. m.	0	0			0	0	0	0	
3, 9 a. m.	0	0	0	0	0	0	0	0	
5, 3 p. m.	0	0	0	0	0	0	0	0	
7, 12 m.	0	0	0	0	0	0	0	0	
8, 11 a. m.	0	0	0	0	0	0	0	0	
12, 12 m.	0	0	0	0	0	0	0	0	
14, 11 a. m.	0	0	0	0	0	0	0	0	
15, 3 p. m.	0	1	0	0	0	1	0	1	
19, 11 a. m.	0	0	0	0	0	0	0	0	
20, 1 p. m.	0	0	0	0	0	0	0	0	
22, 11 a. m.	0	0	0	0	0	0	0	0	
24, 12 m.	0	0	0	0	0	0	0	0	
26, 9 a. m.	0	0	0	0	0	0	0	0	
27, 1 p. m.	0	0	0	0	0	0	0	0	

Faculae were seen at the time of every observation.

VERIFICATIONS.

INDICATIONS.

The predictions for November, 1886, were made by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for November, 1886, with the telegraphic reports of the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 75.29. The percentages for the different elements are: Weather, 77.42; wind, 72.02; temperature, 73.44. By states, etc., the percentages are: For Maine, 70.86; New Hampshire, 72.69; Vermont, 72.75; Massachusetts, 72.36; Rhode Island, 74.53; Connecticut, 74.62; New York, 80.17; Pennsylvania, 76.22; New Jersey, 80.56; Delaware, 76.64; Maryland, 76.81; District of Columbia, 73.92; Virginia, 76.44; North Carolina, 82.39; South Carolina, 77.50; Georgia, 81.90; Florida, 79.92; Alabama, 75.89; Mississippi, 72.19; Louisiana, 76.28; Texas, 82.31; Arkansas, 72.47; Tennessee, 67.58; Kentucky, 70.25; Ohio, 76.78; West Virginia, 69.14; Indiana, 73.72; Illinois, 73.92; Michigan, 76.14; Wisconsin, 73.83; Minnesota, 73.56; Iowa, 76.58; Kansas, 76.17; Nebraska, 73.58; Missouri, 75.56; Colorado, 74.92; east Dakota, 73.50.

There were four omissions to predict, out of 9,630, or 0.04 per cent. Of the 9,626 predictions that have been made, seven hundred and seventy, or 8.00 per cent., are considered to have entirely failed; six hundred and eight, or 6.32 per cent.,

were one-fourth verified; 1,665, or 1.730 per cent., were one-half verified; 1,664, or 17.29 per cent., were three-fourths verified; 4,919, or 51.10 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Below are given for the Pacific coast the percentages of indications for October, 1886; this data was prepared too late for publication in the October REVIEW. The predictions were made by 2d Lieutenant W. A. Glassford, Signal Corps, U. S. Army, Assistant; they were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant. The percentages for the different districts are: Washington Territory, 72.44; Oregon, 70.44; northern California, 74.82; southern California, 77.32.

CAUTIONARY SIGNALS.

During November, 1886, the total number of signals ordered of all kinds, the verifications of which were determined, was three hundred and six, of these, two hundred and twenty-two, or 72.55 per cent., were fully verified both as to direction and velocity. Number of signals ordered for on-shore winds, one; verified, one. Number of signals ordered for northeast winds, thirty-six; verified both as to direction and velocity, twenty-four, or 66.67 per cent.; verified as to velocity only, seven, or 19.44 per cent. Number of signals ordered for southeast winds, sixty; verified both as to direction and velocity, forty, or 66.67 per cent.; verified as to velocity only, nine, or 15.00 per cent. Number of signals ordered for southwest winds, sixty-eight; verified both as to direction and velocity, sixty-one, or 89.71 per cent.; verified as to velocity only, four, or 5.88 per cent. Number of signals ordered for northwest winds, one hundred and eighteen; verified both as to direction and velocity, eighty-two, or 69.49 per cent.; verified as to velocity only, six, or 5.08 per cent. Number of signals ordered for winds without regard to direction, twenty-three; verified, fourteen, or 60.87 per cent. Number of signals ordered late, *i. e.*, after the verifying velocity had begun, four, or 1.31 per cent.

In forty-two instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in twenty-one instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

In addition to the above, six hundred and ninety-three signals were ordered at display stations, the verifications of which it was impracticable to determine.

COLD-WAVE SIGNALS.

During November, 1886, the total number of cold-wave signals ordered, the verifications of which were determined, was two hundred and forty-two; number verified, one hundred and ninety-three, or 79.75 per cent. Thirty-six signals were ordered, the verifications of which it was impracticable to determine. In addition to the above, in five hundred and thirty instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verification of these it was impracticable to determine.

RAILWAY WEATHER SIGNALS.

P. H. Mell, jr., director of the "Alabama Weather Service," in the report for November, 1886, states:

The verification of predictions for the whole area was 80 per cent. for temperature, and 85 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

The following is from the "Bulletin of the New England Meteorological Society" for November, 1886:

Verification of weather signals at New Haven was 83 per cent. for temperature, 90 for weather; at five stations reporting to the Signal Office in Boston, 88.4 for temperature, 88.0 for weather. Local sunset predictions at Blue Hill for twenty-four hours from midnight were verified 77 per cent.; predictions at 8 a. m. for sixteen hours, 90 per cent. The Signal Service indications had a local verification of 70 per cent. Three cold-wave warnings were justified.